

VITAMINS IN ANIMAL NUTRITION

L. J. Finch, '28

Feeding Methods In Relation To Control Of Vitamin Deficiencies; Prevention And Cure Of Vitamin Diseases

Little is known of the nature of vitamins because they exist in natural products in such very small amounts that no one as yet has been able to isolate any of them in a sufficiently pure condition for study. That there are several different vitamins present in foods is evident from the various effects on animals which result when they are lacking in the ration. The different vitamins are distinguished by the differences in the symptoms produced when one or other is deficient in the ration and by differences in solubility and in stability to heat and oxidation. These vitamins have been named A, B, C, D, and E. Another system of naming these vitamins is based on the fact that a deficiency of a certain vitamin in the ration generally produces in an animal a more or less well defined disease. An absence of vitamin C in the diet produces in certain animals a disease called scurvy. Vitamin C is therefore called the anti-scorbutic vitamin. Similarly the other vitamins are named for the disease produced by their lack.

Vitamins are not produced in the animal body. What vitamins are found in the animal body have been stored there. The quantity of stored vitamins depends primarily upon the amount in the ration. If the ration is high in vitamins, the animal may store a large amount, but if the ration is low in vitamins they are used immediately and no storage is possible. Vitamins A and B are stored in large quantities than the other vitamins and are found in greatest concentration in the interval glandular organs, such as the liver and kidney.

Vitamin A, also known as fat-soluble vitamin is required in much greater amount by growing animals than by adult animals. If there is a deficiency of this vitamin in the ration of young animals, their growth will be stunted and general stamina affected. The animal will have less power to meet the demands of reproduction and lactation, and will be less able to resist disease and infection, particularly of the respiratory tract. In some species of animals a deficiency of vitamin, A will cause

an eye soreness known as Xerophthalmia, as a characteristic symptom which will develop into blindness. Adult animals are not likely to show the eye soreness, but will show the vitamin lack by low resistance to diseases and infections of the respiratory tract. This vitamin is often associated with fat, as the name "fat-soluble vitamin implies. This fat is mainly animal fat, vegetable fats containing no appreciable amounts. Codliver oil, egg-yolk fat, and butter fat of milk are the principal sources of this vitamin, however fresh green vegetation supplies a relatively large amount. Seeds in general are not good sources of vitamin A, however among seeds and tubers there seems to exist a relationship between yellow coloring and a high content of this vitamin. Yellow corn is considered a fair source of this vitamin, also yellow carrots and sweet potatoes while the white varieties are considered deficient. Relationship between yellow coloring and stuffs, especially green vegetation, reduces the content of vitamin A. The rate of such destruction is increased by exposure to sun light, or to high temperatures, while clover and alfalfa plants are rich in this vitamin the hays prepared from them have a lower content and especially if they have not been carefully cured and stored.

Vitamin B is also known as the anti-neuritic vitamin and is necessary for the maintenance of life and vigor at all ages. A lack of this vitamin promptly retards growth, impairs the appetite, affects the organs of digestion and reproduction, and causes malnutrition, particularly of the nervous system. In the later stages of this type of under nutrition, nerve inflammation and degeneration often develops, causing partial or complete paralysis of the hind quarters. In human nutrition lack of vitamin B will ultimately cause a disease known as beri-beri, which is particularly prevalent in the Orient. In animals of a similar disease, known as neuritis or a polyneuritis, results from a lack of this vitamin; hence the name of anti-neuritic vitamin has been given it. This vitamin is the

most widely distributed of all. All naturally occurring foods contain it and the lack can only be reasonably suspected in industrial by-product feeds. Polyneuritis can only be induced in animals by feeding rations made up largely or entirely of milled cereals, such as patent white flour, degerminated corn meal, and polish rice. Green plants are very rich in vitamin B and since the process of drying does not destroy it to any great extent hays are also good sources. Grains are also fairly rich in it, the germs being an excellent source. Yeast and wheat germs are standard sources of vitamin B in animal experimentation in nutrition laboratories.

The only function that vitamin C seems to play in the animal body is a protection against scurvy. It is therefore called the anti-scorbutic vitamin. So far as has been learned, only man, monkey, and guinea pigs are affected by a lack of this vitamin. Farm animals are not susceptible to scurvy, at least they have been successfully reared from weaning to maturity on rations that would cause scurvy in guinea pigs in the course of three or four weeks. This vitamin is found in fewer foods than any of the other vitamins. The juices of oranges, lemons, raspberries, strawberries, and tomatoes are the richest sources. Acid fruit juices may be boiled or even evaporated to dryness without losing their anti-scorbutic property, however, in foods in which there is no such acid the vitamin is lost even on drying at low temperature.

Experiments with animals during the last few years have shown clearly that rickets is a disease caused mainly by faulty nutrition; that it is produced in growing animals by the continued use of rations ill balanced with respect to calcium and phosphorous and deficient in the fourth vitamin called D or the anti-rachitic vitamin. On such rations there is a marked disturbance of the concentration of phosphorous in the blood, and a failure of these elements to deposit in the bones. The bones thus fail to harden or calcify.

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Rickets seems to be disease confined to civilized races and to domesticated animals. Savage races living under what may be called natural conditions do not have rickets, nor do wild animals. It seems to be associated, therefore, with artificial conditions of living. Rickets is prevalent among children; rather common among pigs, lambs, kids, puppies and chickens, and less common among calves, colts, and rabbits. The anti-rachitic vitamin also is a fat-soluble vitamin and, so far, has been found in greatest concentration in animal fats. Cod Liver Oil is particularly rich in it, and is known to be an excellent remedy for rickets. Egg yolk, whole milk, and meat are also effective to lesser degree. Vegetable oils are very poor in vitamin D content or else entirely free from it. The anti-rachitic vitamin is distinct from vitamin A with which it is generally associated in animal fats, by the fact that it is little affected by heat and exposure to the air. Cod Liver Oil may be kept at the boiling point of water for

twenty-four hours, and may have air forced through it at a rapid rate during this time, with out apparently affecting its anti-rachitic value, though its content of vitamin A will be entirely destroyed. An interesting fact of great practical importance is that exposure of animals to direct sun light will serve the same purpose in promoting growth as the anti-rachitic vitamin. The ultra-violet rays in sunlight seem to be entirely or largely responsible for this beneficial action, possibly by enabling the animal to manufacture the vitamin. There are three types of rickets; (1) due to low phosphorus content of the blood, causing enlarged joints and rachitic rosary to develop, (2) due to low calcium content which causes a tetany condition, (3) due low calcium and phosphorus, both which results in the enlargement of the medullary spaces of the bones. Rickets may be induced or prevented by (1) changing amounts of calcium and phosphorus in the blood, (2) a deficiency or abundance of the anti-rachitic vitamin, (3) a deficiency or adequacy of ultra-violet rays from direct sunlight or quartz-mercury vapor lamp.

In recent years a fifth vitamin has been discovered and is known as vitamin E or anti-sterility vitamin. This vitamin affects the sterility of animals, destroying the germ cells in males and interfering with the proper functioning of the placental organ in females. Vitamin E is widely distributed in food stuffs and a lack does not occur naturally. This vitamin is stored in the animal body and is distributed in the muscles, fat, internal organs, and milk. Oils of cereals are especially rich in this vitamin and seeds and green leaves contains it to a less extent. This vitamin is also classed as a fat-soluble vitamin being soluble in all proportions. Exposure to heat, light and air does not seem to have any affect on it.

While grains and grain by-products are ill balanced foods with respect to minerals, protein, and vitamins, fresh green forage and good hays, are rich in minerals, fairly rich in proteins, and a good source of vitamins A and B. Roughages are therefore good supplements to the grains and their by-products, the combination of the two in proper proportion giving a complete and adequate ration in all respects. Since vitamin C is not needed to farm animals, and

vitamin E is contained in most all food stuffs, these two vitamins are not a matter of concern to the farm. With most farm animals a deficiency of the anti-rachitic vitamin in the ration may not be a matter of concern since direct sunlight is a sufficient substitute for it.

GREAT HOLSTEIN SHOW PROMISED AT 1928 NATIONAL DAIRY SHOW

According to S. H. Anderson, Executive Secretary of the National Dairy Show which will be held for the second time at Memphis, Tennessee, October 13 to 20, one of the greatest Holstein shows in history is promised as indicated by the list of exhibitors. Of the 940 head entered 230 are of the Holstein breed and are to be shown by twenty-six exhibitors from eleven states. The breeders who will exhibit at this great show are as follows:

Harry Anthes, Ft. Atkinson, Wis., 1 head; Arbu Farms, A. H. Buhl, owner, Oxford, Mich., 1 head; Bell Farm, Coraopolis, Pa., 14 head; Carnation Milk Farms, Oconomowoc, Wis., 22 head; Chapman Farms, Kansas City, Mo., 16 head; C. O. Christ, Ft. Atkinson, Wis., 3 head; Detroit Creamery Co., Mt. Clemens, Mich., 15 head; Elmwood Farm, Deerfield, Ill., 16 head; Femco Farms, Breckenridge, Minn., 13 head; Eugene Fleming, Jefferson, Wis., 1 head; Fredmar Farms, Jefferson Barracks, Mo., 14 head; Edwin J. Graper, Ft. Atkinson, Wis., 1 head; C. E. Griffith, Big Cabin, Okla., 13 head; Hurlwood Holstein Farm, Ashby Falls, Mass., 1 head; Jefferson Co. Asylum, Jefferson, Wis., 9 head; J. B. Jones, Detroit, Mich., 14 head; Maricopa Creamery Co. Phoenix, Ariz., 13 head; Marshall Gafke, Oregon, Wis., 1 head; The Maytag Farms, Newton, Iowa, 5 head; Milford Meadows Farm, Lake Mills, Wis., 1 head; H. E. Robertson York, Pa., 16 head; Rock River Farms, Byron, Ill., 10 head; State Bd. of Control, Des Moines, Ia., 3 head; Misconsin State Hospital, Mendota, Wis., 5 head; Wisconsin School for the Blind, Janesville, Wis., 16 head; and Harry Yates, Orchard Park N. Y., 6 head.

While fresh fruits and vegetables are plentiful, use them to replace more expensive foods.

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